CAPROLACTAM

Caprolactam was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 105-60-2

Molecular Formula: $C_6H_{11}NO$

Caprolactam is a white solid in the form of flakes or fused. It has an unpleasant odor and taste. Caprolactam is freely soluble in water, methanol, ether, chloroform, dimethylformamide, tetrahydrofurfuryl alcohol, chlorinated hydrocarbons, cyclohexene, and petroleum fractions (Merck, 1989).

Physical Properties of Caprolactam

Synonyms: 2-azacycloheptanone; hexahydro-2H-azepin-2-one; aminocaproic lactam; 2-oxohexamethyleneimine

Molecular Weight:	113.16
Boiling Point:	139 °C at 12 mm Hg
Melting Point:	70 °C
Vapor Pressure:	0.0019 mm Hg at 25 °C
Density/Specific Gravity:	1.02 at 75/4 °C (liquid) (water = 1)
Log/Octanol Water Partition Coefficient:	-0.19
Water Solubility:	5,250,000 mg/L at 25 °C
Conversion Factor:	1 ppm = 4.63 mg/m^3 (as gas)

(Howard, 1990; HSDB, 1991; Sax, 1989)

SOURCES AND EMISSIONS

A. Sources

Caprolactam is used for the manufacture of nylon materials, plastics, paints, coatings, and floor polishes. It is also used as a cross-linking agent for polyurethanes and synthesis of amino acid lysine (Sax, 1987).

B. Emissions

No emissions of caprolactam from stationary sources in California were reported, based on data obtained from the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of caprolactam was found in the readily-available literature.

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of caprolactam.

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of caprolactam was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

No information about the atmospheric persistence of caprolactam was found in the readily-available literature.

AB 2588 RISK ASSESSMENT INFORMATION

Caprolactam emissions are not reported from stationary sources in California under the AB 2588 program. It is also not listed in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines as having health values (cancer or non-cancer) for use in risk assessments (CAPCOA, 1993).

HEALTH EFFECTS

Probable routes of human exposure to caprolactam are inhalation and dermal contact.

Non-Cancer: High exposure to caprolactam can cause convulsions. Exposure by inhalation to caprolactam also causes severe irritation to the eyes and respiratory tract, and direct contact is highly irritating to the eyes and skin. Acute inhalation exposure to caprolactam has been observed to cause central nervous system effects including headaches, malaise, and confusion. In one case, a man exposed to high levels of caprolactam over three days developed dermatitis,

fever, and grand mal seizures. Chronic exposure of workers to caprolactam has been observed to cause peeling of the hands, and some eye, skin, and throat irritation (U.S. EPA, 1994a).

The United States Environmental Protection Agency (U.S. EPA) has not established a Reference Concentration (RfC) for caprolactam, but has set the oral Reference Dose (RfD) at 0.5 milligrams per kilogram per day based on reduced offspring bodyweight in rats. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects (U.S. EPA, 1994a).

Adverse gynecological effects have been reported in women occupationally exposed to caprolactam and other chemicals. These effects include dysmenorrhea, menorrhagia, oligomenorrhea, and obstetrical complications including postpartum hemorrhage, toxemia of pregnancy, premature birth, and inadequate uterine contractions during labor. Inhalation exposure has been reported to cause adverse effects on spermatogenesis in rats (U.S. EPA, 1994a).

Cancer: No information is available on the carcinogenic effects of caprolactam in humans. Rats and mice exposed to caprolactam in their diet at the maximum tolerated dose did not develop a significant increase in tumor incidence. The U.S. EPA has classified caprolactam in Group E: Evidence of non-carcinogenicity in humans (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified caprolactam in Group 4: Probably not carcinogenic in humans (IARC, 1987a).